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(54) MAGNETIC SHIELD MATERIAL AND MANUFACTURE THEREOF

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a magnetic shield material which is excellent in stability of shielding characteristics even if various kinds of stress are applied to it, excellent in shielding characteristics, and less deteriorated in an environment of high temperature and humidity.

SOLUTION: A magnetic shield material comprises flat soft magnetic alloy powder and binder, wherein the soft magnetic alloy powder is composed of positive magnetostrictive soft magnetic alloy powder and negative magnetostrictive soft magnetic alloy powder. Amorphous alloy powder is used as positive magnetostrictive soft magnetic alloy powder, and crystalline alloy powder is used as zero or negative soft magnetic alloy powder. Paint which contains positive magnetostrictive flat soft magnetic alloy powder and paint which contains zero or negative magnetorestrictive flat soft magnetic alloy powder are mixed together to serve as final paint for application.

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CLAIMS

[Claim(s)]
[Claim 1] Magnetic-shielding material which it is with soft magnetism after alloy powder with the soft magnetism after alloy powder in which flat-like soft magnetism after alloy powder and a binder are contained, and said soft magnetism after alloy powder has positive magnetostriction, zero, or negative magnetostriction.
[Claim 2] Magnetic-shielding material of Claim 1 whose soft magnetism after alloy powder with positive magnetostriction is amorphous after alloy powder and whose soft magnetism after alloy powder with zero or negative magnetostriction is crystalline substance after alloy powder.

[Claim 3] The manufacture method of the magnetic-shielding material which has the process which mixes the coating material containing the soft magnetism after alloy powder of the shape of flat [with positive magnetostriction], and the coating material containing the soft magnetism after alloy powder of the shape of flat [with zero or negative magnetostriction].
[Claim 4] The manufacture method of the magnetic-shielding material of Claim 3 which manufactures Claim 1 or the magnetic-shielding material of 2.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to magnetic-shielding material and its manufacture method.
[0002]
[Description of the Prior Art] In order that magnetic field sources, such as a magnetization object, may not affect other objects, electric circuits, etc., magnetic-shielding material is used. Although the metal plate of high permeability is desirable from shield characteristics as

magnetic-shielding material, as for a metal plate, a use is remarkably restricted in respect of character, cost, etc. On the other hand, it applies to a flexible base material suitable in applying this to the required part of a shield in the form of a coating material in the case of a powder material etc., and various use in considering it as a shield board is possible.

[0003] Various kinds of proposals are made about the magnetic-shielding material using the powder of high permeability.

[0004] For example, to JP,S59-201493,A, the magnetic-shielding coating material which mixed the flat-like powder which ground the soft magnetism amorphous alloy in the binder of a high molecular compound is indicated.

[0005] To JP,S58-59268,A, the magnetic-shielding coating material which mixed the flat-like powder of the high permeability alloy in the binder of a high molecular compound is indicated.

[0006] In JP,S58-50495,Y, using the paint film of a flaky Sendust alloy as a magnetic-shielding film is indicated.

[0007] In JP,S62-58631,B, a Fe-nickel system alloy, a Fe-nickel-Co system alloy, The grains of flat unfixed form, such as a Fe-Si-aluminum system alloy, a Fe-nickel-Mo system alloy, i.e., a permalloy alloy, and a molybdenum permalloy alloy or the Sendust alloy, are mixed in a high molecular compound binder. The becoming coating material for magnetic shielding is indicated.

[0008] The magnetic-shielding film of the permalloy is indicated in JP,S63-39966,B.

[0009] Using for JP,H1-223627,A the spreading film of the flat magnetism iron powder containing any one sort (Cr=0.5-20 weight %, Si=0.5-9 weight % (one to 16.5 atom %), and aluminum=0.5-15 weight %) as an overcoat for a shield is indicated.

[0010] The Reason for using flat-like alloy grains in such magnetic-shielding films and magnetic-shielding material, It is because an orientation will be carried out so that the principal surface of flat-like alloy grains may serve as film surface inboard if the coating-material-ized magnetic-shielding material is applied, so the flat direction can utilize the high permeability of the material itself from the smallness of the demagnetizing field originating in flat form in accordance with the direction used as magnetic-shielding material. And it is because the fall of the magnetic properties of the film surface inboard by a demagnetizing field is prevented and good magnetic-shielding characteristics are obtained.

[0011] When the above-mentioned Fe group amorphous alloy is used on shield material, since corrosion resistance is good, the environmental damage of shield characteristics is small, but stress deterioration becomes large for positive magnetostriction. Specifically, permeability will deteriorate according to the stress at the time of using it as the stress at the time of kneading the after alloy powder with positive magnetostriction with the stress in the case of flattening, and a binder, and coating-material-izing, and magnetic-shielding material etc. On the other hand, when crystalline substance alloys, such as Sendust, are used on shield material,

generally there is little stress deterioration of shield characteristics because of zero or negative magnetostriction, but since corrosion resistance is low, an environmental damage becomes large.

[0012] In addition, although permeability generally does not deteriorate in the stress at the time of coating-material-izing after alloy powder with negative magnetostriction, permeability may deteriorate according to the stress by tension etc. Thus, even if after alloy powder has negative magnetostriction, the correspondence to various stresses is difficult, and there is a problem in respect of the stability of shield characteristics.

[0013]

[Problem(s) to be Solved by the Invention] The purpose of this invention has the good stability of shield characteristics, even when various stresses are added, and its shield characteristics are good, and it is offering magnetic-shielding material with little deterioration of the shield characteristics under a high-humidity/temperature environment moreover.

[0014]

[Means for Solving the Problem] Such a purpose is attained by one composition of following the (1) - (4).

(1) Magnetic-shielding material which it is with soft magnetism after alloy powder with the soft magnetism after alloy powder in which flat-like soft magnetism after alloy powder and a binder are contained, and said soft magnetism after alloy powder has positive magnetostriction, zero, or negative magnetostriction.

(2) Magnetic-shielding material of the above (1) whose soft magnetism after alloy powder with positive magnetostriction is amorphous after alloy powder and whose soft magnetism after alloy powder with zero or negative magnetostriction is crystalline substance after alloy powder.

(3) The manufacture method of the magnetic-shielding material which has the process which mixes the coating material containing the soft magnetism after alloy powder of the shape of flat [with positive magnetostriction], and the coating material containing the soft magnetism after alloy powder of the shape of flat [with zero or negative magnetostriction].

(4) The manufacture method of the magnetic-shielding material the above (3) which manufactures the above (1) or the magnetic-shielding material of (2).

[0015]

[Function and Effect] The soft magnetism after alloy powder of the shape of flat [with the soft magnetism after alloy powder of the shape of flat / which has positive magnetostriction in magnetic-shielding material /, zero, or negative magnetostriction] is made to contain in this invention. For this reason, deterioration of the shield characteristics by various kinds of stresses is reduced. For example, although the permeability of soft magnetism after alloy powder with positive magnetostriction deteriorates in the stress by a binder, the permeability of

the soft magnetism after alloy powder of zero magnetostriction does not deteriorate, but the permeability of soft magnetism after alloy powder with negative magnetostriction improves on the contrary according to this stress. When the power pulled on the other hand depending on the kind of external force added to shield material, for example is added, the permeability of soft magnetism after alloy powder with negative magnetostriction deteriorates, but the permeability of the soft magnetism after alloy powder which has positive magnetostriction in this case improves on the contrary. Therefore, even when what kind of stress is added, the shield characteristic degradation as the whole shield material is eased.

[0016] Moreover, if crystalline substance after alloy powder is used as soft magnetism after alloy powder with zero or negative magnetostriction, using amorphous after alloy powder as soft magnetism after alloy powder with positive magnetostriction With the corrosion resistance height of amorphous after alloy powder, and the height of the magnetic properties of crystalline substance after alloy powder, magnetic-shielding material with it is realized. [high corrosion resistance and] [good / shield characteristics] Since the inside of the field of flat-like grains becomes carry out the orientation of the after alloy powder which consists of flat-like grains by spreading, and almost parallel [the after alloy powder] to the inside of a film surface, the amorphous after alloy powder near the paint film surface will cover the after alloy powder inside a paint film, and good corrosion resistance is acquired. Therefore, in order to suppress the fall of magnetic properties, even when the ratio of amorphous after alloy powder is made low, sufficient corrosion resistance is acquired. In addition, such a corrosion-resistant improvement effect becomes high especially, when the corrosion resistance of the crystalline substance after alloy powder near the shield material surface is low. That is, if the corrosion resistance low crystalline substance after alloy powder near the shield material surface is rusted and eluted, the whole shield material surface surface will be covered with corrosion resistance high amorphous after alloy powder, the oxide of crystalline substance after alloy powder, a binder, etc., and the protective effect inside shield material will become remarkably high.

[0017] As the soft magnetism after alloy powder for magnetic-shielding material was mentioned above, although flattened, the optimum conditions in the case of this flattening usually differ for every material. That is, in order to manufacture the flat powder of the form optimal as powder for an applied type shield, and a size, it is necessary to choose flat conditions suitably according to brittleness peculiar to a material, ductility, etc. Although flattening is usually performed by a wet type, it is necessary to choose the optimal solvent according to a material in this case. Powdered surface description changes with the influences of the solvent used at this time a lot. Moreover, surface description changes also with powdered presentations. For this reason, it is difficult to mix uniformly several flat-like powder with which materials differ, and if it is going to knead with a binder and is going to coating-

material-ize after mixing powder simply, powdered dispersion will become almost impossible and coating material-ization will become impossible substantially. It is considered to be based on such a Reason that the shield material which mixed two or more flat powder is not proposed conventionally.

[0018] On the other hand, in this invention, after kneading with a binder and coating-material-izing for every powder, in order to mix coating materials, the good coating material of powdered dispersion is obtained.

[0019]

[Elements of the Invention] The concrete composition of this invention is explained in detail hereafter.

[0020] The magnetic-shielding material of this invention contains flat-like soft magnetism after alloy powder and a binder. In this invention, soft magnetism after alloy powder with the soft magnetism after alloy powder which has positive magnetostriction as soft magnetism after alloy powder, zero, or negative magnetostriction is used.

[0021] Although the concrete combination in particular with soft magnetism after alloy powder with soft magnetism after alloy powder with positive magnetostriction, zero, or negative magnetostriction is not limited It is desirable to use crystalline substance after alloy powder as a thing of zero or negative magnetostriction from both corrosion resistance and shield characteristics becoming good as mentioned above, using amorphous after alloy powder as a thing of positive magnetostriction.

[0022] It is desirable to use what consists of a Fe group amorphous alloy as amorphous after alloy powder with positive magnetostriction. As for especially the presentation of amorphous after alloy powder, what contains a ferromagnetic metal which is indicated by JP,H2-180005,A, and a vitrification element that what is necessary is just what is not limited but has the suitable magnetic properties for magnetic-shielding material is desirable. As a ferromagnetic metal in this case, B, Si, C, P, germanium, etc. are B and Si especially as what replaced Fe or its part with Co or nickel, and a vitrification element. Specifically, it is a formula. (Fe1-y Niy) The presentation expressed with 100-x-w Mx w (Si, B) is desirable. the above-mentioned formula expresses an atomic ratio -- x= 0-10 -- desirable -- 2-8, y= 0 to 0.4, and w= 15-37 -- it is 18-30 preferably. Moreover, M is at least one sort of Ti, V, Nb, Ta, Zr, Cr, Mo, W, Mn, and Co, and it is desirable that at least one sort of Cr and Nb, especially Cr are included as indispensable from a corrosion resistance point. If x exceeds 10, the fall of saturation magnetization will pose a problem. w= 15-37 is an amorphous formation field.

[0023] Although a crystalline substance alloy in particular with zero or negative magnetostriction may not be limited, either, for example, you may be any, such as the Sendust system alloy and a permalloy system alloy It is the after alloy powder 3 currently preferably indicated by Tokuganhei2-115583, i.e., DO. A Fe-Si-aluminum system alloy with structure, The

after alloy powder currently indicated by Tokuganhei2-97241, i.e., the after alloy powder which added Cr to the presentation centering on Fe3 Si, is desirable, and the after alloy powder currently especially indicated by Tokuganhei2-97241 is desirable. In a composition diagram (atomic ratio), the presentation of this after alloy powder 3 yuan of Fe, Si, and Cr A:Fe78Si22Cr0, B: When referred to as Fe70Si30Cr0, C:Fe60Si30Cr10, D:Fe63Si18Cr19, and E:Fe76Si18Cr6, it is the presentation expressed on the neighborhood of five square shapes obtained by connecting A, B, C, D, E, and A in order, and in its inside. This alloy is also DO3. It is desirable to have structure. DO3 Since cleavage comes to arise easily by having structure, flattening mentioned later becomes easy. Moreover, corrosion resistance becomes good when Cr is included.

[0024] In addition, each soft magnetism after alloy powder with soft magnetism after alloy powder with positive magnetostriction and zero, or negative magnetostriction may contain two or more sorts of after alloy powder.

[0025] Saturation magnetostriction lambdas of the soft magnetism after alloy powder used by this invention lambdas of the after alloy powder which has positive magnetostriction although not limited in particular It is desirable that it is +5x10-6 to +35x10-6. lambdas If too small, saturation magnetization will become small and will become inadequate [magnetic-shielding characteristics]. On the other hand, it is lambdas. If too large, change of the permeability by a stress will become large too much. Moreover, lambdas of after alloy powder with zero or negative magnetostriction It is desirable that it is 0--10x10-6. lambdas If it becomes large too much at a negative side, change of the permeability by a stress will become large too much.

[0026] [the mixed ratio with soft magnetism after alloy powder with soft magnetism after alloy powder with positive magnetostriction, zero or negative magnetostriction] Although what is necessary is just to determine or determine experimentally in consideration of the saturation magnetostriction of each after alloy powder, permeability, corrosion resistance, mean particle diameter, an aspect ratio, etc. Although it has the positive magnetostriction in the whole soft magnetism after alloy powder, a ratio is 20 to 40 weight % still more preferably 20 to 50weight % more preferably ten to 90weight %. If this ratio is too low, the corrosion resistance of magnetic-shielding material will become low. On the other hand, if this ratio is too high, the permeability of magnetic-shielding material will become low according to the stress by a binder.

[0027] As for soft magnetism after alloy powder, it is desirable that it is flat [-like]. The average thickness of flat-like soft magnetism after alloy powder is 1 micrometer. It is 0.01-1 micrometer especially hereafter. It comes out and a certain thing is desirable. Average thickness is 0.01 micrometer. If it becomes the following, the dispersibility to a binder will fall. Moreover, magnetic properties, such as permeability, fall and shield characteristics become inadequate. On the other hand, average thickness is 1 micrometer. Since the paint film with which soft

magnetism after alloy powder was distributed uniformly cannot be formed and the number of existence of the flat-like soft magnetism grains of the thickness direction of a paint film will decrease when applying magnetic-shielding material thinly if it exceeds, shield characteristics become inadequate. In addition, average thickness is 0.01-0.6 micrometer. A more desirable result will be obtained if it becomes. What is necessary is just to measure average thickness with an analyzed type scanning electron microscope.

[0028] As for the average aspect ratio of flat-like soft magnetism after alloy powder, it is desirable 10-3000 and that it is especially 10-500. In this Description, an average aspect ratio is the value which **(ed) mean particle diameter of flat-like soft magnetism powder with the average thickness. The influence of a demagnetizing field becomes it large that an average aspect ratio is less than ten, magnetic properties, such as permeability, fall and shield characteristics become inadequate. Since mean particle diameter becomes large too much when an average aspect ratio exceeds 3000 in the flat-like soft magnetism after alloy powder which, on the other hand, has the above-mentioned average thickness within the limits, when kneading with a binder, a fracture arises and magnetic properties deteriorate easily.

[0029] In addition, the mean particle diameter in this case is a grain size of grains when the weighted mean grain size D50 is meant, the weight of the grains which constitute soft magnetism after alloy powder is integrated from the one where a grain size is smaller and this value reaches 50% of the weight of the whole soft magnetism after alloy powder. Moreover, the grain size in this case is a grain size measured with the grading-analysis plan which used light scattering measurement. The grading analysis using light scattering measurement measures the Fran Hofer diffraction or the scattering angle of Mie scattering by making laser light, a halogen lamp, etc. into a light source, circulating through a sample, for example, and, more specifically, measures particle size distribution. These details are indicated, for example to "fine-particles and industrial" VOL.19 No.7 (1987). The particle size distribution acquired with such a grading-analysis meter can determine above D50. As for the flat-like soft magnetism after alloy powder used by this invention, D50 which does in this way and is determined is 5-30 micrometers. It is 5-25 micrometers especially. It comes out and a certain thing is desirable.

[0030] moreover, the time of setting the length (diameter of the minimum) of a and a brachydiagonal to b for the length (overall diameter) of the macro axis in the principal surface form of grains -- an average of [of an axial ratio] -- when directivity is required of magnetic shielding, the 1.2 or more largest possible values of a/b are desirable. When the source of a magnetic field has directivity, if a magnetic coating material is stiffened making an orientation magnetic field act in the direction, improvement in the permeability of the direction can be performed and the magnetic-shielding effect can be enlarged. In this case, a more desirable result is obtained as a/b is 1.2-5. And according to the medium agitation mill mentioned later,

such an axial ratio is easily realizable. What is necessary is just to measure the macro axis and brachydiagonal of grains with an analyzed type transmission electron microscope.

[0031] Next, the manufacture method of flat-like soft magnetism after alloy powder is explained.

[0032] There is no restriction in particular in the method that what is necessary is for quenching of a molten metal and grinding of an alloy ingot just to perform manufacture of after alloy powder. Although there is no restriction in particular in the method of quenching a molten metal, it is desirable for the after alloy powder of a desired grain size to be obtained without a crushing step, and to use the water atomizing method, since productivity is high. The water atomizing method injects high-pressure water to a molten metal, coagulation and after carrying out pulverization, it cools underwater and the details are indicated to Tokuganhei1-12267 by this invention persons, for example. A molten metal besides the water atomizing method may be made to collide with a cooling base, and the method of obtaining the shape of a thin band, a thin film integrated circuit, or a granular alloy may be used. As such a method, the ** rolling method, and a twin-roll process or the atomizing method is mentioned. What is necessary is to grind the obtained quenching alloy if needed and just to consider it as the after alloy powder of a desired grain size by these methods. When manufacturing after alloy powder by grinding of an alloy ingot, grinding is desirable after performing condition-ized treatment to in GO@TTO. The mean particle diameter of after alloy powder is usually 5-30 micrometers at the weighted mean grain size D50, although what is necessary is just to determine suitably according to the grain size and aspect ratio of flat-like powder which are made into the purpose. It is 7-20 micrometers preferably. Then, it is good. In addition, it is desirable that heat treatment for preparing crystal structure is performed to after alloy powder.

[0033] There is no restriction in particular in a means to flatten after alloy powder, and as long as desired flattening is possible, you may use what kind of means. However, since flattening of alloy grains advances mainly by cleavage in crystalline substance after alloy powder which was described above, it is desirable to use a means by which cleavage can be performed efficiently. As such a means, a medium agitation mill, a rolling ball mill, etc. are mentioned, and it is [among these] desirable to use especially a medium agitation mill. A medium agitation mill is an agitator called a pin type mill, a bead mill, or an agitator ball mill, for example, is indicated to Tokuganhei1-12267 by JP,S61-259739,A and this invention persons etc. It is desirable to use a medium agitation mill also for flattening of amorphous after alloy powder which was described above on the other hand. In amorphous after alloy powder, rolling and shearing are made by a mill, and amorphous-ization is advanced simultaneously.

[0034] It is desirable to perform flattening with a wet method. In this case, what is necessary is just to choose the optimal solvent from alcohols, such as methyl alcohol, ethyl alcohol, and IPA, toluene, acetone, etc., corresponding to the kind of after alloy powder. In addition, you

may add a grinding aid etc. in a solvent.

[0035] To flat-like soft magnetism grains, it is desirable that heat treatment is performed. This heat treatment is DO3 with the crystalline substance after alloy powder which is for raising magnetic properties and was described above. It is for forming or preparing type crystal structure.

[0036] heat treatment to amorphous after alloy powder -- usually -- 350-500 degrees C - during 10 minutes -- what is necessary is just to carry out for about 5 hours Moreover, what is necessary is for 300-500 degrees C just to usually perform preferably heat treatment to the above mentioned crystalline substance alloy at 100-600 degrees C for for 30 minutes to 2 hours for for 10 minutes to 10 hours. Treatment temperature is too low, or if processing time is too short, the effect by heat treatment will become inadequate, treatment temperature is too high, or if processing time is too long, it will be easy to produce ignition and sintering. In addition, it is desirable to perform heat treatment in a vacuum or inert gas atmosphere, such as nitrogen, hydrogen, and Ar. You may perform this heat treatment all over a magnetic field.

[0037] The magnetic-shielding material of this invention contains the soft magnetism after alloy powder and the binder which are obtained by doing in this way, and soft magnetism after alloy powder is distributed in the binder.

[0038] As for the coating material for magnetic-shielding material production, it is desirable to mix and prepare the coating material containing soft magnetism after alloy powder with positive magnetostriction and the coating material containing soft magnetism after alloy powder with zero or negative magnetostriction. When two or more sorts of after alloy powder was invested in the solvent (vehicle) which dissolved the binder and it mixes, Since surface description changes remarkably with flat treatment when dispersion becomes very difficult by the difference in the surface description of after alloy powder and after alloy powder is flattened especially, coating material-ization will be impossible substantially.

[0039] The vehicle in particular used for coating material-ization of each after alloy powder is not limited, but what is necessary is just to use various well-known organic solvents etc. for a solvent that what is necessary is just to use well-known thermoplastics, a thermosetting resin, radiation-curing nature resin, etc. for a binder. In addition, since hardening of a coating material performs after mixing both coating materials, as for the vehicle used for each coating material preparation, it is desirable to choose suitably so that curing conditions may become almost the same.

[0040] In order to form a uniform paint film, it is desirable to make content of the after alloy powder in the last coating material after mixing into 40 to 95 weight %, but it is desirable to also make content of each after alloy powder in each coating material before mixing into such a range.

[0041] In addition, in the coating material, the curing agent, the dispersant, the stabilizer, the

coupling agent, etc. may be contained.

[0042] The last coating material is applied or fabricated, and subsequently, heating hardening is carried out if needed and it is usually used as magnetic-shielding material. What is necessary is just to heat hardening at 50-80 degrees C in heating oven generally for about 1 to 100 hours.

[0043] As for the filling factor of the soft magnetism after alloy powder in magnetic-shielding material, it is desirable that it is 60 to 95 weight %. If the magnetic-shielding effect decreases rapidly that a filling factor is less than 60 weight % and it exceeds 95 weight %, soft magnetism after alloy powder cannot be firmly connected with a binder, but the hardness of magnetic-shielding material will fall. The especially good magnetic-shielding effect is acquired as a filling factor is 70 to 90 weight %, and the hardness of shield material is also enough.

[0044] When using the magnetic-shielding material of this invention for magnetic shielding as scarious or laminated, the thickness of magnetic-shielding material is 5-200 micrometers. It comes out and a certain thing is desirable. The magnetic-shielding material [of considering it as such a thickness range] of this invention is 5 micrometers. Thickness also shows the high magnetic-shielding effect. Moreover, it is 200 micrometers when shield material shields the magnetic field which has the hardness which is a magnetic saturation toughness grade. Even if it forms in the thickness which exceeds, the magnetic-shielding effect does not improve notably, but it is 200 micrometers. It is because it is advantageous also in cost if it carries out the following.

[0045] When applying a coating material, it can be considered as the high magnetic-shielding material of directivity by applying an orientation magnetic field or carrying out an orientation mechanically. When magnetic-shielding material is especially made tabular or filmy, the high magnetic-shielding effect is shown to the magnetic field of a direction parallel to a film surface, and effect sufficient in the above thickness ranges is shown.

[0046] In addition, it may face applying to magnetic-shielding material, conductive films, such as Cu and nickel, may be formed in soft magnetism after alloy powder, and an oxide film may be prepared in the surface for corrosion-resistant improvement.

[0047] The magnetic-shielding material of this invention using such soft magnetism after alloy powder is inexpensive and highly efficient, and can be applied to the very large range besides being magnetic shielding, such as a magnetic card, a loudspeaker, and CRT, etc.

[0048]

[Example] Hereafter, a concrete example is given and this invention is explained still in detail.

[0049] After alloy powder was manufactured by the <amorphous after-alloy-powder coating material> water atomizing method, and amorphous-ization was advanced, while rolling and shearing and flattening in ethyl alcohol using the medium agitation mill subsequently. Subsequently, heat treatment was performed at 450 degrees C for 1 hour, and amorphous

after alloy powder was obtained. The presentation (atomic ratio) of this amorphous after alloy powder is Fe68Cr3 Nb4 Si 17B8, and D50 is 15 micrometers. Average thickness is 0.2 micrometer. The aspect ratio was 75. In addition, average thickness was measured with the analyzed type scanning electron microscope, and D50 was measured with the grading-analysis meter using light scattering. Moreover, saturation magnetostriction lambdas in this presentation It measured. In addition, lambdas It measured by the minute magnetization rotating method using the amorphous ribbon. A result is shown in Table 1.

[0050] This amorphous after alloy powder was mixed with the vehicle which consists of a binder, a following curing agent, and a following solvent, and it was considered as coating material-ization.

[0051] Binder chlorination vinyl vinyl acetate system copolymer [S REKKUA (made by Sekisui Chemical Co., Ltd.)] 100 weight part polyurethane [NIPPORAN 2304 (made by Japanese polyurethane company)] 100 weight part (solid part conversion)

[0052] Curing agent polyisocyanate [coronate HL (made by Japanese polyurethane company)] 10 weight part [0053] Solvent MEK850 weight part [0054] {Amorphous after-alloy-powder/ (amorphous after-alloy-powder + binder + curing agent)} in a coating material could be 80 weight %.

[0055] After alloy powder was manufactured by the <crystalline substance after-alloy-powder coating material> water atomizing method, subsequently after alloy powder was flattened in toluene using the medium agitation mill, it heat-treated further, and crystalline substance after alloy powder was obtained. Heat treatment was performed at 350 degrees C for 1 hour in the nitrogen-gas-atmosphere mind containing oxygen of 1 volume %. When it analyzes by X-ray diffraction after heat treatment, the peak of indices of crystal plane (002) is accepted, and it is DO3. It was checked that type crystal structure exists. The presentation (atomic ratio) of this crystalline substance after alloy powder is Fe77Si20Cr3, and D50 is 15 micrometers. Average thickness is 0.2 micrometer. The aspect ratio was 75. Saturation magnetostriction lambdas in this presentation It is shown in Table 1. lambdas It measured with 3 terminal volumetric method. It coating-material[as well as the above-mentioned amorphous after-alloy-powder coating material]-ized using this crystalline substance after alloy powder.

[0056] Next, the two above-mentioned sorts of coating materials were mixed so that amorphous after alloy powder and crystalline substance after alloy powder might serve as a ratio shown in Table 1, and it was considered as the last coating material for magnetic shielding. The medium agitation mill was used for mixing. Subsequently, it is 75 micrometers in thickness about the last coating material. It is 25 micrometers to a long PET board. After applying to thickness and rolling round in the shape of a roll, at 60 degrees C, it heated for 60 minutes and hardened. This was cut in the shape of a sheet, and it was considered as the shield board sample. Moreover, the sample which used the amorphous after-alloy-powder

coating material and the crystalline substance after-alloy-powder coating material as the last coating material independently, respectively for comparison was also produced.

[0057] magnetic flux phi 0 in case the produced shield board sample is installed on a magnet, leakage flux phi in the position of 0.5cm is measured from a shield board sample and there are not this and a shield board a ratio -- phi/phi 0 It computed and this was made into the early shield ratio. A result is shown in Table 1. In addition, on this measurement condition, if a shield ratio is 0.1 or less value, sufficient shield effect will be acquired, but it is so desirable that a shield ratio is small in practice.

[0058] Moreover, in order to evaluate the corrosion resistance of shield material, the shield ratio was computed after neglecting each sample by the environment of RH 60 degree C and 95% for 96 hours. A result is shown in Table 1.

[0059] Moreover, in order to investigate deterioration by a stress, the resin board was put on each sample, 1kg/mm2 of load was added, and it asked for the shield ratio at the time of load impression. A result is shown in Table 1.

[0060]

[Table 1]

サンプル No.	混合比率（重量%） アモルファス合金粉末	結晶質合金粉末	λs (×10⁻⁶)	シールド比 初期	放置後	応力印加時
1（比較）	100	0	+20	0.08	0.08	0.25
2（比較）	0	100	-5	0.04	0.12	0.03
3	15	85	—	0.04	0.06	0.03
4	30	70	—	0.07	0.07	0.07
5	60	40	—	0.08	0.08	0.10

[0061] While good shield characteristics are obtained from Table 1 by using together two sorts of after alloy powder, even if it uses it under a high-humidity/temperature environment, it turns out that deterioration of shield characteristics becomes small, and that deterioration of the shield characteristics at the time of load impression is suppressed. On the other hand, with the comparison sample which uses only one sort of powder, the shield ratio at the time after neglect of stress impression is over 0.1.

[0062] In addition, after mixing the above-mentioned amorphous after alloy powder after flattening, and the above-mentioned crystalline substance after alloy powder after flattening, when it kneaded with the above-mentioned vehicle, familiarity by both after alloy powder and a vehicle was bad, dispersion became it is remarkable and poor and coating-material-izing was substantially impossible.

[0063] The effect of this invention is clear from the above example.

[Translation done.]